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IMPACT OF ENHANCED RECOVERY AFTER SURGERY (ERAS) PROTOCOLS ON RECOVERY TIME AND COMPLICATION RATES IN LAPAROSCOPICALLY PERFORMED SURGERIES: A PROSPECTIVE COMPARATIVE STUDY

General Surgery

Dr Mukesh Kumar* Postgraduate Resident, Department of General Surgery, G.S.V.M. Medical College, Kanpur, Uttar Pradesh, India*Corresponding Author

Dr Anurag Singh Guide, Department of General Surgery, G.S.V.M. Medical College, Kanpur, Uttar Pradesh, India

Dr R. K. Singh Professor and Head, Department of General Surgery, G.S.V.M. Medical College, Kanpur, Uttar Pradesh, India

Dr Priyesh Shukla Co-Supervisor, Associate Professor, Department of General Surgery, G.S.V.M. Medical College, Kanpur, Uttar Pradesh, India

ABSTRACT

Background: Enhanced Recovery After Surgery (ERAS) is a multimodal, evidence-based perioperative care pathway designed to attenuate surgical stress and accelerate functional recovery. While ERAS has demonstrated benefit across several surgical specialities internationally, institution-specific data from Indian tertiary-care centres evaluating its effect specifically within laparoscopic surgery remain limited. **Aim:** To analyse the impact of ERAS protocol implementation on recovery time and postoperative complication rates in patients undergoing common laparoscopic surgical procedures, and to compare outcomes with conventional perioperative care.**Materials and Methods:** This prospective, cross-sectional, comparative observational study was conducted in the Department of General Surgery, G.S.V.M. Medical College, Kanpur, over a two-year period (2024–2026). Seventy-five patients aged 18–60 years undergoing laparoscopic appendicectomy, cholecystectomy, or hernioplasty were enrolled and categorised into a Control group receiving conventional perioperative care (n=48) and an ERAS group managed per a structured ERAS pathway (n=27). Time to ambulation, length of hospital stay, recovery status, and postoperative complications were compared using the independent t-test, Chi-square/Fisher's exact test, correlation, multiple linear regression, ANCOVA, and binary logistic regression, with $p<0.05$ taken as significant. **Results:** The two groups were comparable at baseline for age, gender, BMI, comorbidity profile, and operative duration ($p>0.05$ for all). Mean time to ambulation was significantly shorter in the ERAS group (16.5 ± 3.8 hours) than in controls (18.7 ± 3.4 hours; $p<0.001$), and mean length of hospital stay was significantly reduced (1.33 ± 0.48 days vs 1.83 ± 0.38 days; $p<0.001$), with 66.7% of ERAS patients discharged within 24 hours compared with 16.7% of controls. Complete recovery was achieved in 74.1% of the ERAS group versus 0% of controls ($p<0.001$). Overall postoperative complication rates were statistically similar between groups (25.9% vs 25.0%; $p=0.931$). Regression analysis confirmed that ERAS independently reduced hospital stay and ambulation time after adjustment for age and BMI.**Conclusion:** Implementation of the ERAS protocol in laparoscopic surgery was associated with significantly earlier ambulation, shorter hospital stay, and a markedly higher rate of complete early recovery, without an increase in postoperative morbidity. These findings support wider institutional adoption of ERAS pathways for laparoscopic procedures in resource-conscious tertiary-care settings.

KEYWORDS

Enhanced Recovery After Surgery, Eras, Laparoscopic Surgery, Length Of Hospital Stay, Ambulation, Postoperative Complications.

INTRODUCTION

Surgical care has undergone substantial transformation with advances in anaesthesia, minimally invasive techniques, and evidence-based perioperative management (Jameson, 2023). Traditional perioperative pathways, based largely on surgical dogma rather than evidence, have relied on prolonged fasting, liberal drain use, delayed oral feeding, and restricted mobilisation—practices associated with an exaggerated stress response, insulin resistance, impaired wound healing, and delayed functional recovery.

Enhanced Recovery After Surgery (ERAS) represents a paradigm shift in perioperative management that integrates multimodal, evidence-based interventions across the preoperative, intraoperative, and postoperative phases of care. ERAS pathways emphasise patient education, nutritional optimisation, avoidance of prolonged fasting, opioid-sparing multimodal analgesia, goal-directed fluid therapy, early enteral feeding, and early mobilisation. These pathways have been adapted across colorectal, hepatobiliary, gynaecological, urological, and general laparoscopic surgery, with consistent improvements in recovery and patient satisfaction (Ljungqvist et al., 2021).

Laparoscopic surgery itself confers recognised advantages over open surgery, including reduced tissue trauma, lower postoperative pain, and earlier return of bowel function. The integration of ERAS principles with laparoscopic surgery is considered synergistic, as both strategies aim to minimise surgical stress and accelerate recovery. However, most available ERAS evidence originates from high-income healthcare systems, and institution-specific data from Indian tertiary-care settings evaluating ERAS specifically within laparoscopic surgery remain comparatively limited (Oodit et al., 2022).

The present study was undertaken to analyse the impact of ERAS protocol implementation on recovery time and the incidence of postoperative complications in patients undergoing common laparoscopic surgical procedures, and to compare patient outcomes between ERAS-based care and conventional perioperative management.

MATERIALS AND METHODS

Study design and setting: This was a prospective, cross-sectional, comparative observational study conducted in the Department of General Surgery, G.S.V.M. Medical College and associated U.H.M. District Hospital, Kanpur, over a two-year period from 2024 to 2026.

Sample size: The sample size was calculated using the standard formula for estimating a proportion, assuming an expected postoperative complication rate of 20% ($Z=1.96$, $d=0.09$), yielding a calculated size of approximately 76 patients; the final enrolled sample size was 75 patients recruited consecutively after informed consent.

Inclusion criteria: Patients aged 18–60 years who provided written consent and were fit for laparoscopic surgery were included.

Exclusion criteria: Immunocompromised patients; patients aged <18 or >60 years; patients with tuberculosis, bleeding disorders, diabetes mellitus, or other major comorbidities; patients not providing consent; pregnant females; and patients unfit for surgery were excluded.

Grouping: Patients undergoing laparoscopic appendicectomy, cholecystectomy, or hernioplasty were categorised into a Control group receiving conventional perioperative care (n=48) and an ERAS group managed according to a structured ERAS protocol (n=27), based on the perioperative pathway followed.

Follow-up: All patients were followed for six months postoperatively through scheduled outpatient visits to assess recovery, late complications, and readmissions.

Statistical analysis: Continuous variables (age, BMI, ambulation time, hospital stay) were expressed as mean ± standard deviation and compared using the independent t-test. Categorical variables were expressed as frequencies/percentages and compared using the Chi-square test or Fisher's exact test. Pearson correlation, multiple linear regression, ANCOVA, and binary logistic regression were used for advanced multivariate analysis. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 75 patients undergoing laparoscopic procedures were included, comprising 48 patients (64.0%) managed with conventional perioperative care and 27 patients (36.0%) managed per the ERAS protocol. Surgical indications comprised appendicectomy (n=26), cholecystectomy (n=25), and hernioplasty (n=24).

Baseline comparability: The two groups were well matched for age (38.65 ± 12.92 vs 37.92 ± 13.84 years; p=0.794), gender distribution (p=0.956), BMI (26.85 ± 8.12 vs 25.25 ± 7.21 kg/m²; p=0.347), substance-use history, pre-operative vital parameters, haemoglobin, liver and kidney function, glycaemic indices, and mean operative duration (64.8 ± 4.5 vs 64.6 ± 4.8 minutes; p=0.841), confirming that recovery differences were unlikely to reflect demographic, physiological, or operative confounding.

Table 1: Baseline Characteristics of Study Groups

Parameter	Control (n=48)	ERAS (n=27)	p-value
Mean age (years)	38.65 ± 12.92	37.92 ± 13.84	0.794
Male : Female	21 : 27	12 : 15	0.956
Mean BMI (kg/m²)	26.85 ± 8.12	25.25 ± 7.21	0.347
Mean surgery duration (min)	64.8 ± 4.5	64.6 ± 4.8	0.841

Primary recovery outcomes: Mean time to ambulation was significantly shorter in the ERAS group (16.5 ± 3.8 hours) than in the control group (18.7 ± 3.4 hours; p<0.001), with early ambulation (≤15 hours) achieved by 51.9% of ERAS patients versus 16.7% of controls. Mean length of hospital stay was significantly reduced in the ERAS group (1.33 ± 0.48 days vs 1.83 ± 0.38 days; p<0.001); 66.7% of ERAS patients were discharged within 24 hours compared with 16.7% of controls. Complete recovery was recorded in 74.1% of the ERAS group versus 0% of controls, while delayed recovery occurred in 75.0% of controls and in no ERAS patient (p<0.001).

Table 2: Primary Recovery Outcomes

Outcome	Control (n=48)	ERAS (n=27)	p-value
Mean time to ambulation (hrs)	18.7 ± 3.4	16.5 ± 3.8	<0.001
Early ambulation ≤15 hrs, n (%)	8 (16.7%)	14 (51.9%)	<0.001
Mean hospital stay (days)	1.83 ± 0.38	1.33 ± 0.48	<0.001
Discharge within 24 hrs, n (%)	8 (16.7%)	18 (66.7%)	<0.001
Complete recovery, n (%)	0 (0.0%)	20 (74.1%)	<0.001

Postoperative complications: Overall complication incidence did not differ significantly between groups (25.0% in controls vs 25.9% in the ERAS group; p=0.931). Postoperative ileus occurred less frequently with ERAS (7.4% vs 12.5%), while postoperative fever (11.1% vs 8.3%) and surgical site infection (7.4% vs 4.2%) were broadly comparable (Fisher's exact p>0.05 for all).

Table 3: Postoperative Complications

Complication	Control (n=48)	ERAS (n=27)	p-value
Any complication, n (%)	12 (25.0%)	7 (25.9%)	0.931
Postoperative ileus	6 (12.5%)	2 (7.4%)	0.710
Postoperative fever	4 (8.3%)	3 (11.1%)	0.695
Surgical site infection	2 (4.2%)	2 (7.4%)	0.612

Advanced statistical modelling: Time to ambulation correlated positively with length of hospital stay. On multiple linear regression, ERAS independently reduced hospital stay and ambulation time after adjustment for age and BMI, while higher BMI and older age independently predicted longer stay and slower mobilisation. ANCOVA confirmed that the effect of ERAS on hospital stay remained significant after adjustment for baseline BMI.

DISCUSSION

The present study demonstrates that implementation of an ERAS protocol in laparoscopic surgery was associated with significantly earlier ambulation, shorter hospital stay, and a markedly higher proportion of complete early recovery, without a significant increase in postoperative morbidity. Because the ERAS and control groups were well matched for demographic, physiological, and operative variables, the observed differences in recovery are more plausibly attributable to the perioperative care pathway than to baseline imbalance.

The finding of significantly earlier ambulation with ERAS is consistent with previous literature. Ostermann et al. (2019), in a randomised trial of elderly colorectal patients, similarly reported improved postoperative recovery and shorter hospital stay with an enhanced recovery programme. Sauro et al. (2024), in a meta-analysis of randomised trials across surgical specialities, found ERAS to be associated with reduced length of stay and fewer complications. Comparable benefits have been reported in paediatric abdominal and colorectal surgery (Hidayah et al., 2023; Su et al., 2023) and in minimally invasive bariatric surgery (Gao et al., 2023).

The reduction in length of hospital stay observed here, though numerically modest in absolute terms, is clinically meaningful in a high-volume tertiary-care setting, where even a half-day reduction per patient can improve bed turnover and reduce cost. This is in agreement with O'Neill et al. (2023), who reported reduced length of stay in gynaecological surgery without increased readmission, and with the broader ERAS Society position that structured perioperative optimisation is feasible and beneficial even in resource-limited settings (Oodit et al., 2022).

Despite the clear recovery benefit, overall postoperative complication rates did not differ significantly between groups. This is an important safety finding, indicating that accelerated recovery and early discharge under ERAS did not compromise patient safety. This is consistent with prior work showing that the complication-reduction benefit of ERAS is often more apparent in larger pooled analyses than in single-centre cohorts of modest size (Sauro et al., 2024), and likely reflects the already low baseline morbidity associated with laparoscopic surgery itself.

Regression and ANCOVA analyses further indicated that ERAS independently predicted shorter hospital stay and faster ambulation even after adjustment for age and BMI, while older and heavier patients still required more intensive mobilisation support. This suggests that ERAS benefits a broad range of patients, though individualised discharge planning may still be warranted in higher-risk subgroups.

Limitations: This was a single-centre study with a modest and unequal group size, non-randomised allocation to ERAS versus conventional care, and a relatively short primary follow-up window for late complications. Larger, ideally randomised, multicentric studies are required to confirm these findings and to determine whether ERAS meaningfully reduces the overall complication burden in laparoscopic surgery.

CONCLUSION

Implementation of the ERAS protocol in patients undergoing laparoscopic surgery was associated with significantly earlier ambulation, shorter hospital stay, and a markedly better early recovery profile compared with conventional perioperative care, without an increase in postoperative complications. These findings support the incorporation of ERAS pathways into routine laparoscopic surgical practice in Indian tertiary-care hospitals as a safe and effective strategy to improve recovery, patient satisfaction, and hospital resource utilisation.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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None.

ETHICALAPPROVAL

The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrolment.

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